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IMPORTANCE OF INTEGRATION OF PEDAGOGY AND TECHNOLOGY IN SCIENCE TEACHING

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ABSTRACT

This paper addresses the integration of pedagogy and technology in science teaching. For a teacher to grow professionally continuous effort is required. To prepare students for the science and technology for the future, the current science education reforms ask science teachers to integrate technology and inquiry-based teaching into their instruction. Good teaching starts with reasoning and continues with imparting and involving. To make effective pedagogical decisions regarding what to teach and how to teach it, teachers should develop both their Pedagogical Content Knowledge (PCK) and pedagogical reasoning skills. Here the role of science education, the aim of science education, purpose of science education, changing trends in science education, meeting the changing needs in science education, role of Information and Communication Technology (ICT) in transforming teaching and learning, the link between ICT and pedagogy has been discussed. At the conclusion it states that though integration of technology and pedagogy is essential for better science teaching but a balance between pedagogy and technology is required to avail the greatest benefit.

INTRODUCTION:

Science teaching is a complex, dynamic profession that it is difficult for a teacher to stay up-to-date. For a teacher to grow professionally a continuous effort is required. To better prepare students for the science and technology, the current science education reforms ask science teachers to integrate technology and inquiry-based teaching into their instruction. Utilizing technology tools in inquiry-based science classrooms allows students to work as scientists [1]. It is argued that teachers not only need to know their content but also need to know how to present it effectively. To make effective pedagogical decisions about what to teach and how to teach it, teachers should develop both their PCK and pedagogical reasoning skills.

In recent years, many researchers in the field of educational technology have been focused on the role of teacher knowledge on technology integration [2]. The basis of effective teaching with technology requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of how technology can help redress some of problems that students face [3]. Opportunities for discussion reasoning, interpretation and reflection are very important for knowledge building. Introducing technological tools and resources which students can use interactively offers further opportunities for expressing, evaluating and revising their developing ideas.

CURRENT SCIENCE EDUCATION:

This Century, Science will require teachers to adapt and a different set of pedagogic practices. Its goal of fostering 'scientific literacy' involves developing a knowledge not only of the broad explanatory themes of science but also of some of the discourse and practices of scientists, including the processes of theory construction, decision making and communication, and the social factors that influence scientists' work.. Another force for pedagogic change in science education is the new modes of enquiry afforded by computer-based tools and resources, now known collectively as 'Information and Communication Technologies' (ICT). The advent of this educational technology, and its more widespread access in schools, potentially has an important part to play in re-shaping the curriculum and pedagogy of science. In particular, it offers easy access to a vast array of internet resources and other new tools and resources that facilitate and extend opportunities for empirical enquiry both inside and outside the classroom .Thus, in a very real sense, it offers opportunities to dissolve the boundaries that demarcate school science from contemporary science by facilitating access to a wide body of data, such as real-time air pollution measurements, epidemiological statistics, or providing direct links to high quality astronomical telescopes, and providing ready access to a wealth of information about science-in the-making. Such an education would seek to support and develop students 'scientific reasoning, critical reflection and analytic skills. What, then, is the potential of using ICT to support and nurture such a science education? In the following sections of this review, we now examine this potential particularly that envisioned by the current trend in science education which seeks to develop scientific literacy. We also explore the teacher's role in exploiting this potential, and the outcomes.

THE AIMS AND PURPOSE OF SCIENCE EDUCATION:

Thomas Huxley and others, in contrast, saw the function of science education as a means of intellectual development providing opportunities to engage in the exercise of reasoning by analyzing and interpreting data, and using evidence-based arguments for appropriate scientific theories. In addition, it also permitted the testing of speculation. The debates, between the value of the content of science versus its processes, i.e. scientific modes of thinking, were to play themselves out repeatedly in debates about the function and purpose of science education. They can be seen in Armstrong's advocacy of the significance of process, in particular, in his advocacy of an approach to teaching which came to be known as 'guided discovery', and were to emerge again in the 1980s [4] and technological education for the development of a rounded individual [5]. Current research would suggest, however, that there are four common rationales for science education namely utilitarian, economic, cultural and democratic.

THE CHANGING CONTEXT:

Two factors have led to calls for change in the nature of school science education.

The changing relationship between science and society:

The past 30 years have seen a transformation in society's view of science. Today, after long experience environmental and technological disasters such as Chernobyl, global warming, ozone depletion etc. science is seen as a source of threat as well as a source of solutions. Science should be a compulsory part of all school curricula in many countries across the globe. In recent years, however, it has been increasingly argued that compulsory science education can only be justified if it offers something of universal value to all .Hence, in the last decade the democratic and cultural arguments have come to the fore to argue that a complete science education should give a much more holistic picture of science. The most significant product of this debate so far has been the development of a new curriculum entitled Science for Public Understanding.

Meeting the challenge of change:

The changes embodied in these courses are radical. Traditionally school science has ignored any treatment or exploration. Hence, the pedagogy of school science has tended to be didactic, authoritarian and non-discursive with little room for autonomous learning or the development of critical reasoning.

Potential role of ICT in transforming teaching and learning:

While there are changes in the views of the nature of science and the role of science education, the increasing prevalence of ICT also offers a challenge to the teaching and learning of science, and to the models of scientific practice teachers and learners might encounter. ICTs, for example, offer a range of different tools for use in school science activity, including tools for data capture, processing and interpretation. Multimedia software for simulation of processes and carrying out 'virtual, experiments' Information systems particularly beneficial for low ability pupils – while enhancing the use of graphs for interpreting data, spending more time on observation and focused discussion, and developing investigative and analytic skills [6,7]. Use of ICT, especially the internet, can open up access to a broader range of up to-date tools and information resources, and increase the currency and authenticity of schoolwork far beyond that which textbooks and other resources can offer.

The internet also offers some unique opportunities for pupils to experience phenomena such as viewing the Earth from a moving satellite, to develop understanding – particularly of abstract phenomena like electricity. Examples include 'seeing' an electron going around a nucleus or a white cell ingesting bacteria, simulating launch of a space shuttle, and rotating a 3D model of molecules and atoms

in motion. Rapid data presentation and interactive computer models representing a scientific phenomenon or idea not only provide immediate opportunities for study and analysis; they can also encourage pupils to pose exploratory questions and to pursue these by conducting follow-up activities, to access ideas more quickly and easily, to formulate new ideas and transfer them between contexts [8-10].

USE OF ICT AND ROLE OF TEACHER:

Current research would suggest, however that it is not appropriate to assume simply that the introduction of such technologies necessarily transforms science education. Rather we need to acknowledge the critical role played by the teacher, in creating the conditions for ICT-supported learning through selecting and evaluating appropriate technological resources, and designing, structuring and sequencing a set of learning activities. Pedagogy for using ICT effectively includes value to learning activities, pupils prior conceptions and creating time for discussion, reasoning, analysis and reflection.

Teachers' motivation to use ICT in the classroom is, at present, adversely influenced by a number of constraints including: lack of time to gain confidence and experience with technology; limited access to reliable resources; a science curriculum overloaded with content; assessment that requires no use of the technology; and a lack of subject-specific guidance for using ICT to support learning. Teachers tend to use ICT largely to support, enhanced complement existing classroom practice rather than re-shaping subject content, goals and pedagogies. However, teacher motivation and commitment are high and practice is gradually changing.

CONCLUSIONS:

To conclude, teachers are currently working towards harnessing the powerful potential of using ICT to support science learning as far as possible, given the very real operational constraints. Further development depends on providing them with more time, consistent access to reliable resources, encouragement and support, and offering specific guidance for appropriate and effective use. Assessment frameworks (and their focus on end products) may also need to change in order to evaluate – and thereby further encourage ICT supported learning. We can conclude integration of pedagogy with technology in science teaching may facilitate motivation and engagement, help in structuring activity and supporting active reflective learning and developing an investigative approach.

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